Package 'exams2sakai'

April 22, 2021

Title Automatic Generation of Exams in R for 'Sakai'

Version 0.3

Description Automatic Generation of Exams in R for 'Sakai'.
Question templates in the form of the 'exams' package (see <http://www.r-exams.org/>)
are transformed into XML format required by 'Sakai'.

License GPL-2 | GPL-3

Depends R (>= 3.4.0), exams (>= 2.3-6)

Imports glue (>= 1.4.0), stringr (>= 1.4.0), stringi (>= 1.4.6), xml2
(>= 1.2.5)

Suggests knitr, rmarkdown

URL <https://github.com/jesusmmp/exams2sakai>

BugReports <https://github.com/jesusmmp/exams2sakai/issues>

Encoding UTF-8

RoxygenNote 7.1.0

NeedsCompilation no

Author Fuensanta Arnaldos García [aut],
María Victoria Caballero Pintado [aut],
Úrsula Faura Martínez [aut],
María Teresa Díaz Delfa [aut],
Jesús María Méndez Pérez [aut, cre],
Lourdes Molera Peris [aut],
José Antonio Palazón Ferrando [aut],
Juan José Pérez Castejón [aut],
Isabel Parra Frutos [aut],
Raúl Sánchez Sánchez [aut],
Nicolás Andrés Ubero Pascal [aut],
Nikolaus Umlauf [ctb],
Achim Zeileis [ctb] (<https://orcid.org/0000-0003-0918-3766>)

Maintainer Jesús María Méndez Pérez <jesus.mendez@ticarum.es>

R **topics documented:**

---

exams2sakai   *Generation of Exams in IMS QTI Sakai Format*

Description

Automatic generation of exams in IMS QTI Sakai format.

Usage

```
exams2sakai(file, n = 1L, nsamp = NULL, dir = ".",
  name = NULL, quiet = TRUE, edir = NULL,
  tdir = NULL, sdir = NULL, verbose = FALSE,
  resolution = 100, width = 4, height = 4, svg = FALSE, encoding = "",
  num = NULL, mchoice = NULL,
  schoice = mchoice, string = NULL, cloze = NULL,
  template = "qtisakai", duration = NULL,
  stitle = "Exercise", ititle = "Question",
  adescription = "Please solve the following exercises.",
  sdescription = "Please answer the following question.",
  maxattempts = 1, cutvalue = 0, solutionswitch = TRUE,
  zip = TRUE, points = NULL,
  eval = list(partial = TRUE, negative = FALSE),
  converter = "pandoc-mathjax", xmlcollapse = FALSE, ...)

make_itembody_sakai(rtiming = FALSE, shuffle = FALSE,
  rshuffle = shuffle, minnumber = NULL, maxnumber = NULL,
  defaultval = NULL, minvalue = NULL, maxvalue = NULL,
  cutvalue = NULL, enumerate = TRUE, digits = NULL,
  tolerance = is.null(digits), maxchars = 12,
  eval = list(partial = TRUE, negative = FALSE),
  fix_num = TRUE)
```

Arguments

file	character. A specification of a (list of) exercise files.
n	integer. The number of copies to be compiled from `file`.
nsamp	integer. The number(s) of exercise files sampled from each list element of `file`. Sampling without replacement is used if possible. (Only if some element of `nsamp` is larger than the length of the corresponding element in `file`, sampling with replacement is used.)

dir	character. The default is the current working directory.
name	character. A name prefix for resulting exercises and ZIP file.
quiet	logical. Should output be suppressed when calling xweave?
edir	character specifying the path of the directory (along with its sub-directories) in which the files in file are stored (see also xexams).
tdir	character specifying a temporary directory, by default this is chosen via tempfile. Note that this is cleaned up and potentially temporary files are deleted.
sdir	character specifying a directory for storing supplements, by default this is chosen via tempfile.
verbose	logical. Should information on progress of exam generation be reported?
resolution, width, height	numeric. Options for rendering PNG (or SVG) graphics passed to xweave.
svg	logical. Should graphics be rendered in SVG or PNG (default)?
encoding	character, passed to xweave.
num	function or named list applied to numerical (i.e., type num) questions. If num is a function, num will be used for generating the item body of the question, see function make_itembody_sakai(). If num is a named list, these arguments will be passed to function make_itembody_sakai() (or make_itembody_qti21() using exams2qti21()).
mchoice, schoice, string, cloze	function or named list applied to multiple choice, single choice, string, and cloze questions (i.e., type mchoice, schoice, string, and cloze), respectively. See argument num for more details.
template	character. The Sakai template that should be used. Currently, the package provide "sakaiqti.xml".
duration	integer. Set the duration of the exam in minutes.
stitle	character. A title that should be used for the sections. May be a vector of length 1 to use the same title for each section, or a vector containing different section titles.
ititle	character. A title that should be used for the assessment items. May be a vector of length 1 to use the same title for each item, or a vector containing different item titles. Note that the maximum of different item titles is the number of sections/questions that are used for the exam.
adescription	character. Description (of length 1) for the overall assessment (i.e., exam).
sdescription	character. Vector of descriptions for each section.
maxattempts	integer. The maximum attempts for one question, may also be set to Inf.
cutvalue	numeric. The cutvalue at which the exam is passed.
solutionswitch	logical. Should the question/item solutionswitch be enabled? In OLAT this means that the correct solution is shown after an incorrect solution was entered by an examinee (i.e., this is typically only useful if maxattempts = 1).
zip	logical. Should the resulting XML file (plus supplements) be zipped?

points	integer. How many points should be assigned to each exercise? Note that this argument overrules any exercise points that are provided within an "\expoints{}" tag in the .Rnw file. The vector of points supplied is expanded to the number of exercises in the exam.
eval	named list, specifies the settings for the evaluation policy, see function exams_eval.
rtiming, shuffle, rshuffle, minnumber, maxnumber, defaultval, minvalue, maxvalue	arguments used for IMS QTI 1.2 item construction, for details see the XML specification (see IMS Global Learning Consortium, Inc. 2012), especially Section 4. Genereting IMS QTI 2.1 items using exams2qti21() the arguments have similar meaning.
enumerate	logical. Insert potential solutions in enumerated list?
digits	integer. How many digits should be used for num exercises?
tolerance	logical. Should tolerance intervals be used for checking if the supplied num answer/number is correct? The default is to use tolerance intervals if digits = NULL.
maxchars	numeric. Lower bound for the number of characters in fill-in-blank fields. The actual number of characters is selected as the maximum number of characters of this value and the actual solution.
fix_num	logical. This is a special flag to enable/force the display of the correct solutions for numeric exercises/answers as well as to obtain results when archiving tests. Note that this is a workaround, which works e.g. within OLAT.
converter	character. Argument passed on to make_exercise_transform_html. The default for converter is set to "pandoc-mathjax"
xmlcollapse	logical or character. Should line breaks be collapsed in the XML code. If TRUE everything is collapsed with spaces (" ") but other collapse characters could be supplied.
...	further arguments passed on to make_exercise_transform_html.

Details

The Question & Test Interoperability (QTI) is an international XML standard for specifying e-learning tests (IMS Global Learning Consortium, Inc. 2012ab). The standard evolved over various versions with the first release culminating in the QTI 1.2 standard and the stable version of the second release currently at QTI 2.1. While both versions share many similarities, they differ in many details. Hence, separate functions exams2sakai and exams2qti21 are provided. The former has already been thoroughly tested and the latter is still in beta testing stage and might change in future releases.

exams2sakai produces a .zip file that may be uploaded (e.g. in OLAT). This includes the final XML file of the exam/assessment as well as possible supplement folders that include images, data sets etc. used for the exam. It proceeds by (1) calling xweave on each exercise, (2) reading the resulting LaTeX code, (3) transforming the LaTeX code to HTML, and (4) embedding the HTML code in a XML file using the IMS QTI 1.2 standards for assessments and question items.

For steps (1) and (2) the standard drivers in xexams are used. In step (3), a suitable transformation function is set up on the fly using make_exercise_transform_html, see also the details section in exams2html.

For step (4), the function will cycle through all questions and exams to generate the final XML file in IMS QTI 1.2 standard. Therefore, each question will be included in the XML as one section. The replicates of each question will be written as question items of the section.

The function uses the XML template for IMS QTI 1.2 assessments and items to generate the exam (per default, this is the XML file qti12.xml provided in the xml folder of this package). The assessment template must provide one section including one item. exams2sakai will then use the single item template to generate all items, as well as the assessment and section specifications set within the template.

The default template will generate exams/assessments that sample one replicate of a question/item for each section. The usual procedure in exam/assessment generation would be to simply copy \& paste the XML template of the package and adapt it to the needs of the user. Note that all specifiers that have a leading ## in the XML template will be replaced by suitable code in exams2sakai and should always be provided in the template. I.e., the user may add additional tags to the XML template or modify certain specifications, like the number of replicates/items that should be sampled for each section etc.

Per default, the individual question/item bodies are generated by function make_itembody_sakai, i.e. make_itembody_sakai checks the type of the question and will produce suitable XML code. Note that for each question type, either the arguments of make_itembody_sakai may be set within num, mchoice, schoice, string and cloze in exams2sakai, by providing a named list of specifications that should be used, or for each questiontype, a function that produces the item body XML code may be provided to num, mchoice, schoice, string and cloze. E.g., mchoice = list(shuffle = TRUE) will force only multiple choice questions to have a shuffled answerlist.

Note that in OLAT/OpenOLAT num exercises are not officially supported but in fact work correctly. The only drawback is that in certain settings the correct solution is not shown at the end of the assessment (although it is used for all internal computations). Therefore, two workarounds are implemented. Either fix_num can be set to TRUE (default), then a fix is added by double-checking the result, or digits can be set to a fixed value (e.g., digits = 2). In the latter case, the num exercise is represented by a string. Then the answer must be provided exactly to the decimal places specified (e.g., if the exact solution is 16.4562, then the correct answer in the test will be "16.46", i.e., a character string of 5 characters).

Generating exams/assessment in IMS QTI 2.1 format using exams2qti21() and make_itembody_qti21() is performed in a similar way as described above. Note that the IMS QTI 2.1 generators are still work in progress. The generated XML files have been validated using the IMS validator provided at http://membervalidator.imsglobal.org/qti/ (when it was still freely available). Furthermore, a selection of generated exams/assessments has been tested using the ONYX Editor and Player, see https://www.onyx-editor.de/.

Value

exams2sakai return a list of exams as generated by xexams.

make_itembody_sakai return a function that generates the XML code for the itembody tag in IMS QTI Sakai format.

References

IMS Global Learning Consortium, Inc. (2012a). *IMS Question & Test Interoperability: ASI XML Binding Specification Final Specification Version 1.2.* http://www.imsglobal.org/question/

qtiv1p2/imsqti_asi_bindv1p2.html

IMS Global Learning Consortium, Inc. (2012b). *IMS Question & Test Interoperability (QTI) XSD Binding Version 2.1 Final*. http://www.imsglobal.org/question/qtiv2p1/imsqti_bindv2p1.html

BPS Bildungsportal Sachsen GmbH (2014). *ONYX Testsuite*. http://www.bps-system.de/cms/en/products/onyx-testsuite/

Zeileis A, Umlauf N, Leisch F (2014). Flexible Generation of E-Learning Exams in R: Moodle Quizzes, OLAT Assessments, and Beyond. *Journal of Statistical Software*, **58**(1), 1–36. https://www.jstatsoft.org/v58/i01/.

R/Exams in Sakai (Sakai Virtual Conference 2019). 6th November 2019. https://aulavirtual.um.es/access/content/group/COLLAB-3ufsaiywvwzdmvw4rn6ghjl/SVC2019/SVC2019.html

Proyecto de adaptación de R/Exams a la plataforma Sakai (XI Jornadas de Usuarios de R). 14-16 Noviembre 2019. https://aulavirtual.um.es/access/content/group/COLLAB-3ufsaiywvwzdmvw4rn6ghjl/xijur2019/xijur19.html https://canal.uned.es/video/5dd268775578f2766d1cca9d

Tareas y exámenes en Sakai con R/Exams. 25 Marzo 2021. https://youtu.be/4i9YKPiVIrg?t=1920 https://gauss.inf.um.es/umur/

See Also

xexams, ttm, tth, tex2image, make_exercise_transform_html,

Examples

```
## Not run:
## load package and enforce par(ask = FALSE)
library("exams2sakai")
options(device.ask.default = FALSE)

## define an exams (= list of exercises)
myexam <- list( "boxplots", "regression", "scatterplot", "relfreq" )

## output directory
dir.create(mydir <- tempfile())

## generate Sakai quiz in temporary directory
exams2sakai( myexam, n = 1,
                     verbose = TRUE,
                     dir = "mydir", points = c( 1 ) )

dir(mydir)

## End(Not run)
```

Index